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(54) [Title of the Invention]

GRADATION IMAGE DISPLAY APPARATUS AND BACKGROUND IMAGE DISPLAY SYSTEM

(57) [Abstract]

[Object]

The present invention aims at providing a gradation image display apparatus capable of performing gradation display without storing image data for each unit width in which color changes in a gradation image, and saving the capacity of a storage device for storing image data.

[Solving Means]

A gradation image display apparatus includes: a display device 8 for displaying a gradation image; gradation image generation means 11 for generating color data for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width; and display means 7 and 14 for displaying the gradation image on the

display device 8 based on the color data for each unit width generated by the gradation image generation means 11.

[Claims]

[Claim 1]

A gradation image display apparatus, comprising: a display device for displaying a gradation image; gradation image generation means for generating color data for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width; and display means for displaying a gradation image on a display device based on the color data for each unit width generated by the gradation image generation means.

[Claim 2]

The gradation image display apparatus according to claim 1, wherein

the unit width is calculated based on a number of color tone change steps in a gradation image, and a width of a color tone change direction of a gradation image.

[Claim 3]

The gradation image display apparatus according to claim 1 or 2, wherein

the color tone change rate is calculated based on a starting color of a gradation image, an ending color of a gradation image, and a number of color tone change steps in a gradation image.

[Claim 4]

A background image display system, comprising: a display device; pattern graphic image generation means for generating a pattern graphic image according to pattern graphic image information stored in storage means; gradation image generation means for generating color data for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width; and display control means for performing selection based on a display priority order in a display position where a pattern graphic image generated by the pattern graphic image generation means overlays a gradation image generated by the gradation image generation means, and displaying a selected image as a background image on a display device.

[Claim 5]

A background image display system, comprising: a display device; means for setting one or more control areas on a display screen; pattern graphic image generation means for generating a pattern graphic image according to pattern graphic image information stored in storage means; gradation image generation means for generating color data for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width; and means for changing inside and outside a control area a display priority order between a pattern graphic image

generated by the pattern graphic image generation means and a gradation image generated by the gradation image generation means.

[Claim 6]

A background image display system, comprising: a display device; means for setting a plurality of control areas on a display screen; pattern graphic image generation means for generating a pattern graphic image according to pattern graphic image information stored in storage means; gradation image generation means for generating color data for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width in each control area; and display control means for performing selection based on a display priority order in a display position where a pattern graphic image generated by the pattern graphic image generation means overlays a gradation image generated by the gradation image generation means, and displaying a selected image as a background image on a display device.

[Claim 7]

A background image display system, comprising: a display device; means for setting a plurality of control areas on a display screen; pattern graphic image generation means for generating a pattern graphic image according to pattern graphic image information stored in storage means; gradation image generation means for generating color data

for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width in each control area; and means for changing inside and outside a control area a display priority order between a pattern graphic image generated by the pattern graphic image generation means and a gradation image generated by the gradation image generation means.

[Claim 8]

The background image display system according to claim 6 or 7, wherein

data for obtaining a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width is provided for each control area.

[Claim 9]

The background image display system according to claim 6 or 7, wherein

only one type of data for obtaining a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width is provided, and based on the one type of data, a gradation image in each control area is generated.

[Claim 10]

The background image display system according to any of claims 4, 5, 6, 7, 8, and 9, wherein

a unit width is calculated based on a number of color tone change steps in a gradation image, and a width of a color tone change direction.

[Claim 11]

The background image display system according to any of claims 4, 5, 6, 7, 8, 9, and 10, wherein

a color tone change rate is calculated based on a starting color of a gradation image, an ending color of a gradation image, and a number of color tone change steps in a gradation image.

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

The present invention relates to a gradation image display apparatus and a background image display system.

[0002]

[Prior Art]

A model of a pinball machine is provided with a display unit such as a liquid crystal display unit, etc. so that an image according to hit information, etc. can be displayed on a display unit. In this type of display system, a background image (pattern graphic image) and a character image (sprite image) are displayed.

[0003]

Figure 7 shows the conventional configuration of the portion (hereinafter referred to as a background image

display system) required to display a background image in the display system of a pinball machine.

[0004]

The background image display system comprises a CPU 1, a timing signal generation unit 2, CG-ROM 3, a pattern graphic image generation unit 5 having screen data memory 4, a lookup table 6, a D/A converter 7, and a display device 8.

[0005]

The CPU 1 outputs a control signal for output of a predetermined pattern graphic image and control data. The timing signal generation unit 2 outputs a timing signal synchronous with an image signal according to a display parameter obtained from the CPU 1. The timing signal is supplied to the pattern graphic image generation unit 5, the D/A converter 7, and the display device 8.

[0006]

The CG-ROM 3 stores plural pieces of pattern graphic image information P0 ~ Pn as shown in Figure 8. Each piece of pattern graphic image information P0 ~ Pn is the information for generation of an image of a size of a fraction of a predetermined value of the display screen as indicated by E1 ~ Em shown in Figure 9. Therefore, plural pieces of pattern graphic image information generate a pattern graphic image for one screen.

[0007]

Each piece of pattern graphic image information P0 ~

Pn comprises a predetermined number of pieces of pixel information (color code) C0 ~ Ci. The pixel information C0 ~ Ci shown in Figure 8 corresponds to the R, T, and B signals in the parentheses.

[0008]

The screen data memory 4 of the pattern graphic image generation unit 5 stores the addresses (read addresses) of the CG-ROM 3 storing the pattern graphic control data transmitted from the CPU 1, that is, the information about the pattern graphic to be displayed in the screen areas E1 ~ Em as shown in Figure 9.

[0009]

The pattern graphic image generation unit 5 fetches pattern graphic image information (pixel information) based on the control data stored in the screen data memory 4 from the CG-ROM 3. Each piece of pattern graphic image information fetched by the pattern graphic image generation unit 5 is transmitted to the lookup table 6 through a color bus.

[0010]

The lookup table 6 converts the transmitted information (pixel information: color code) to a corresponding video signal (RGB data). The RGB data obtained from the lookup table 6 is transmitted to the display device 8 through the D/A converter 7. The display device 8 displays a pattern graphic image according to the RGB data transmitted from the D/A converter 7 and the timing signal from the timing

signal generation unit 2.

[0011]

In the above-mentioned background image display system, it can be assumed that the three-dimensional and massive effect of a background image can be improved by adopting a gradation image as a background image.

[0012]

For example, assume that, as shown in Figure 10, a central rectangular area e0 and four surrounding trapezoidal areas e1 ~ e4 are set in one screen, and the gradation display in which a color tone changes from inside toward outside of the trapezoidal areas e1 ~ e4. Then, the image displayed in the central rectangular area e0 can be displayed as if it were popped forward and backward on the monitor surface.

[0013]

Furthermore, as shown in Figure 11, when an undersea image is displayed at the loser half e1 of one screen and an image of the sky is displayed at the upper half e2 of the screen, an effect of increasing the natural feeling can be obtained by performing gradation display, in which a color tone changes in the vertical direction, on at least one of the undersea image and the image of the sky.

[0014]

[Problems to be Solved by the Invention]

In the conventional gradation image display apparatus, it has been necessary to prepare different pieces of pattern graphic data for the respective areas e0 ~ ep in which a

color tone changes to perform the gradation display as shown in Figure 12.

[0015]

Therefore, to perform precise gradation display in a wide range, a large volume of pattern graphic data has to be prepared, which causes the problem that a large capacity of CG-ROM is required for storing pattern graphic data.

[0016]

The present invention aims at providing a gradation image display apparatus and a background image display system capable of performing gradation display without storing image data for each unit width in which color changes in a gradation image, and saving the capacity of a storage device for storing image data.

[0017]

Furthermore, the present invention aims at providing a background image display system capable of displaying a gradation image as a background image on all or a part of a display screen.

[0018]

[Means for Solving the Problems]

The gradation image display apparatus according to the present invention includes: a display device for displaying a gradation image; gradation image generation means for generating color data for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone

change rate for each unit width; and display means for displaying a gradation image on a display device based on the color data for each unit width generated by the gradation image generation means.

[0019]

The unit width can be calculated based on a number of color tone change steps in a gradation image, and a width of a color tone change direction of a gradation image. The color tone change rate can be calculated based on a starting color of a gradation image, an ending color of a gradation image, and a number of color tone change steps in a gradation image.

[0020]

According to the gradation image display apparatus of the present invention, the gradation display can be performed without storing image data for each unit width in which a color tone changes in a gradation image. Therefore, the capacity of the storage device for storing image data can be saved.

[0021]

The first background image display system according to the present invention includes: a display device; pattern graphic image generation means for generating a pattern graphic image according to pattern graphic image information stored in storage means; gradation image generation means for generating color data for each unit width based on a starting color of a gradation image, a unit width in which

a color tone is changed in the gradation image, and a color tone change rate for each unit width; and display control means for performing selection based on a display priority order in a display position where a pattern graphic image generated by the pattern graphic image generation means overlays a gradation image generated by the gradation image generation means, and displaying a selected image as a background image on a display device.

[0022]

The second background image display system according to the present invention includes: a display device; means for setting a plurality of control areas on a display screen; pattern graphic image generation means for generating a pattern graphic image according to pattern graphic image information stored in storage means; gradation image generation means for generating color data for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width; and means for changing inside and outside a control area a display priority order between a pattern graphic image generated by the pattern graphic image generation means and a gradation image generated by the gradation image generation means.

[0023]

The third background image display system according to the present invention includes: a display device; means for setting a plurality of control areas on a display screen;

pattern graphic image generation means for generating a pattern graphic image according to pattern graphic image information stored in storage means; gradation image generation means for generating color data for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width in each control area; and display control means for performing selection based on a display priority order in a display position where a pattern graphic image generated by the pattern graphic image generation means overlays a gradation image generated by the gradation image generation means, and displaying a selected image as a background image on a display device.

[0024]

The fourth background image display system according to the present invention includes: a display device; means for setting a plurality of control areas on a display screen; pattern graphic image generation means for generating a pattern graphic image according to pattern graphic image information stored in storage means; gradation image generation means for generating color data for each unit width based on a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width in each control area; and means for changing inside and outside a control area a display priority order between a pattern

graphic image generated by the pattern graphic image generation means and a gradation image generated by the gradation image generation means.

[0025]

In the third or fourth background image display system according to the present invention, data for obtaining a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width can be provided for each control area. Additionally, only one type of data for obtaining a starting color of a gradation image, a unit width in which a color tone is changed in the gradation image, and a color tone change rate for each unit width is provided, and based on the one type of data, a gradation image in each control area can be generated.

[0026]

In the first, second, third, or fourth background image display system according to the present invention, a unit width can be calculated based on a number of color tone change steps in a gradation image, and a width of a color tone change direction. Additionally, a color tone change rate can be calculated based on a starting color of a gradation image, an ending color of a gradation image, and a number of color tone change steps in a gradation image.

[0027]

According to the first, second, third, or fourth background image display system of the present invention,

a gradation image can be displayed as a background image on all or a part of the display screen, and the gradation display can be performed without storing image data for each unit width in which a color tone changes in a gradation image. Therefore, the capacity of the storage device for storing image data can be saved.

[0028]

[Embodiments of the Invention]

The embodiments of the present invention are described below by referring to the attached drawings.

[0029]

Figure 1 shows the configuration of a background image display system. In Figure 1, the components also shown in Figure 7 are assigned the same reference numerals, and the explanation is omitted here.

[0030]

In this background image display system, as compared with the pattern graphic display device shown in Figure 7, a gradation image generation unit 11 having gradation memory 12, a border color generation unit 13, and a selection circuit 14 are added.

[0031]

Figure 2 shows the layer of the screen of the display device 8.

[0032]

A normal pattern graphic display comprises a pattern graphic surface 33 on which plural pieces of pattern graphic

data are displayed, and a border surface 31 arranged under the pattern graphic surface 33. A border surface refers to a surface on which no image data is displayed, and is basically black or one of other colors (border color). In this embodiment, a gradation surface 32 on which gradation data is displayed is provided between the border surface 31 and the pattern graphic surface 33.

[0033]

Described below is the operation of the background image display system shown in Figure 1.

[0034]

First, a control signal for output of a target screen and control data are output from the CPU 1. The control data is stored in the screen data memory 4.

[0035]

The pattern graphic image generation unit 5 retrieves pattern graphic image information (pixel information) from the CG-ROM 3 based on the control data stored in the screen data memory 4, performs a necessary process, and outputs the result to the color bus.

[0036]

The pattern graphic image information output to the color bus is transmitted to the lookup table 6, and converted to RGB data. The RGB data (hereinafter referred to as pattern graphic data) for the pattern graphic is transmitted to the selection circuit 14.

[0037]

The border color generation unit 13 stores the RGB data of a border color set by the CPU 1, and the RGB data (hereinafter referred to as border color data) indicating the border color is transmitted to the selection circuit 14.

[0038]

In the gradation image generation unit 11, the CPU 1 sets gradation control data. In this example, as shown in Figure 3, the RGB data indicating the starting color of gradation, the unit width in which a color tone changes, and a color tone change rate for each unit width are set. In the gradation image generation unit 11, the RGB data for each unit width is generated by sequentially adding and subtracting the color tone change rate for each unit width to and from the starting color. The RGB data for each unit width is stored as gradation data in the gradation memory 12. According to the timing signal input to the gradation image generation unit 11, the gradation data corresponding to a display position is sequentially transmitted to the selection circuit 14.

[0039]

In the selection circuit 14, input data is selected and output for the pattern graphic data, gradation data, and border color data based on a predetermined priority order. The display priority order is set such that the pattern graphic data can be assigned the highest priority, the gradation data the next highest priority, and the border

color data the lowest priority. That is, the display priority order is set as pattern graphic data > gradation data > border color data.

[0040]

Therefore, if pattern graphic data is input, the pattern graphic data is selected. If the pattern graphic data is not input and gradation data is input, then the gradation data is selected. If the pattern graphic data and the gradation data are not input, then border color data is selected.

[0041]

The data output from the selection circuit 14 is transmitted to the display device 8 through the D/A converter 7.

[0042]

If a gradation ON/OFF control signal is input to the selection circuit 14, and a gradation control signal is input, then border color data is set not to be selected. If gradation OFF control signal is input, then gradation data can be set not to be selected.

[0043]

Figure 4 shows the configuration of another background image display system. In Figure 4, the component also shown in Figure 1 is assigned the same reference numeral, and the explanation is omitted here. A normal display priority order is set such that the pattern graphic data can be assigned the highest priority, the gradation data the next highest

priority, and the border color data the lowest priority (pattern graphic data > gradation data > border color data).

[0044]

In this background image display system, as compared with the background image display system, a window signal generation circuit 21 is added.

[0045]

In the window signal generation circuit 21, as shown in Figure 5, the CPU 1 sets the starting point coordinates (coordinates of the upper left portion of the window) (xmin, ymin) of a window 41, and the ending point coordinates (coordinates of the lower right portion of the window) (xmax, ymax) of the window 41. The CPU 1 can set one or more windows.

[0046]

According to the timing signal, the window signal generation circuit 21 outputs a window signal when the display position indicated by the timing signal is in a period inside the window. The window signal output from the window signal generation circuit 21 is transmitted to the selection circuit 14.

[0047]

When a window signal is input, that is, when the display position is inside the window, the selection circuit 14 selects input data and outputs it based on the display priority order which is different from the normal order. For example, based on the display priority order in which the display priorities of the pattern graphic data and

the gradation data are inverted, input data is selected and output. In this case, the display priority order is gradation data > pattern graphic data > border color data.

[0048]

That is, for the display position inside the window, if gradation data is input, the gradation data is selected. If gradation data is not input and pattern graphic data is input, then the pattern graphic data is selected. If the gradation data and the pattern graphic data is not input, then the border color data is selected.

[0049]

When a window signal is not input, that is, when the display position is outside the window, the selection circuit 14 selects input data and outputs it based on the normal display priority order. In this case, the display priority order is pattern graphic data > gradation data > border color data.

[0050]

That is, for the display position outside the window, if pattern graphic data is input, the pattern graphic data is selected. If the pattern graphic data is not input and gradation data is input, then the gradation data is selected. If the pattern graphic data and the gradation data is not input, then border color data is selected.

[0051]

If a gradation ON/OFF control signal is input to the selection circuit 14, and a gradation control signal is input,

then border color data is set not to be selected regardless of the presence/absence of a window signal. If gradation OFF control signal is input, then gradation data can be set not to be selected regardless of the presence/absence of the window signal.

[0052]

Figure 6 shows the configuration of another background image display system.

[0053]

The configuration of the background image display system is almost the same as that of the background image display system shown in Figure 4, but the difference from the background image display system shown in Figure 4 is that the window signal of the window signal generation circuit 21 is not transmitted to the selection circuit 14, but is transmitted to the gradation image generation unit 11. The normal display priority order is set such that the pattern graphic data can be assigned the highest priority, the gradation data the next highest priority, and the border color data the lowest priority (pattern graphic data > gradation data > border color data).

[0054]

Another difference from the background image display system shown in Figure 4 is that the RGB data indicating the starting color of gradation, a unit width in which a color tone changes, and a color tone change rate for each unit width are set for each window or commonly for the windows

in the gradation image generation unit 11.

[0055]

In the gradation image generation unit 11, for each window, the RGB data for each unit width is generated by sequentially adding and subtracting the color tone change rate for each unit width to and from the starting color. The RGB data for each unit width is stored as gradation data in the gradation memory 12. According to the window signal and the timing signal input to the gradation image generation unit 11, the gradation data corresponding to a display position in each window is sequentially transmitted to the selection circuit 14.

[0056]

In the selection circuit 14, input data is selected and output for the pattern graphic data, gradation data, and border color data based on a predetermined priority order (pattern graphic data > gradation data > border color data).

[0057]

Therefore, if pattern graphic data is input, the pattern graphic data is selected. If the pattern graphic data is not input and gradation data is input, then the gradation data is selected. If the pattern graphic data and the gradation data are not input, then border color data is selected.

[0058]

Therefore, in a window, if pattern graphic data is not input, gradation data is selected.

[0059]

If a gradation ON/OFF control signal is input to the selection circuit 14, and a gradation ON control signal is input, then border color data is set not to be selected. If gradation OFF control signal is input, then gradation data can be set not to be selected.

[0060]

In the background image display system shown in Figure 6, a window signal of the window signal generation circuit 21 can be transmitted to the selection circuit 14.

[0061]

In this case, when a window signal is input, that is, when the display position is inside the window, the selection circuit 14 selects input data and outputs it based on the display priority order which is different from the normal order. For example, based on the display priority order in which the display priority orders of the pattern graphic data and the gradation data are inverted, input data is selected and output. In this case, the display priority order is gradation data > pattern graphic data > border color data.

[0062]

When a window signal is not input, that is, when the display position is outside the window, the selection circuit 14 selects input data and outputs it based on the normal display priority order. In this case, the display priority order is pattern graphic data > gradation data > border color

data.

[0063]

If a gradation ON/OFF control signal is input to the selection circuit 14, and a gradation control signal is input, then border color data is set not to be selected regardless of the presence/absence of a window signal. If gradation OFF control signal is input, then gradation data can be set not to be selected regardless of the presence/absence of the window signal.

[0064]

In the above-mentioned embodiment, RGB data indicating the starting color of the gradation, a unit width for changing a color tone, and a color tone change rate for each unit width are set in the gradation image generation unit 11. Instead of setting a unit width, the number of steps shown in Figure 3 is set, and the gradation surface width or a window width is divided by the number of steps to calculate the unit width. Furthermore, instead of setting the color tone change rate for each unit width, the number of steps and the ending color of the gradation can be set to calculate the color tone change rate for each unit width from the number of steps and the ending color of the gradation.

[0065]

The gradation data in which a color tone changes in the horizontal direction or the vertical direction can be generated, or the gradation data in which a color tone changes diagonally can be generated. For example, the gradation

display is set in the horizontal direction and the vertical direction (the starting color is the same data), and the gradation data obtained based on the set value in the horizontal direction is sequentially multiplied by the gradation data obtained based on the set value in the vertical direction, thereby generating the data.

[0066]

When gradation display is performed, no gradation display surface is provided, but the gradation display can be performed on the border.

[0067]

According to the above-mentioned embodiment, when the gradation display is realized, it is not necessary to prepare pattern graphic data for each unit width in which a color tone changes. Therefore, the capacity of CG-ROM storing pattern graphic data can be saved.

[0068]

[Advantages of the Invention]

According to the gradation image display apparatus of the present invention, the gradation display can be performed without storing image data for each unit width in which a color tone changes in a gradation image. Therefore, the capacity of the storage device for storing image data can be saved.

[0069]

According to the present invention, a background image display system capable of displaying a gradation image as

a background image on all or a part of the display screen.

[Brief Description of the Drawings]

[Figure 1]

Figure 1 is a block diagram of the configuration of a background image display system.

[Figure 2]

Figure 2 is a schematic chart of the layer of the screen of the display device.

[Figure 3]

Figure 3 is a schematic chart indicating gradation control data.

[Figure 4]

Figure 4 is a block diagram of the configuration of another background image display system.

[Figure 5]

Figure 5 is a schematic chart indicating the starting point and the ending point of the window.

[Figure 6]

Figure 6 is a block diagram of the configuration of a further background image display system.

[Figure 7]

Figure 7 is a block diagram of the configuration of the conventional background image display system.

[Figure 8]

Figure 8 is a schematic chart showing the pattern graphic image information stored in the CG-ROM.

[Figure 9]

Figure 9 is a schematic chart showing the control data stored in the pattern graphic memory and a screen area corresponding to the control data.

[Figure 10]

Figure 10 is a schematic chart showing an example of increasing a three-dimensional effect by the gradation display.

[Figure 11]

Figure 11 is a schematic chart showing an increase in a massive effect by a gradation display.

[Figure 12]

Figure 12 is a schematic chart showing an example of gradation display.

[Description of Symbols]

1 CPU

2 Timing signal generation unit

3 CG-ROM

4 Screen data memory

5 Pattern graphic image generation unit

6 Lookup table

7 D/A converter

8 Display device

11 Gradation image generation unit

12 Gradation memory

13 Border color generation unit

14 Selection circuit

21 Window signal generation circuit

Figure 1

2 TIMING SIGNAL GENERATION UNIT

4 SCREEN DATA MEMORY

5 PATTERN GRAPHIC IMAGE GENERATION UNIT

6 LOOKUP TABLE

7 D/A CONVERTER

8 DISPLAY DEVICE

11 GRADATION IMAGE GENERATION UNIT

12 GRADATION MEMORY

13 BORDER COLOR GENERATION UNIT

14 SELECTION CIRCUIT

#1 CPU CONTROL SIGNAL

#2 TIMING SIGNAL

#3 CPU DATA BUS

#4 ROM DATA

#5 ROM ADDRESS

#6 COLOR BUS

Figure 2

33 PATTERN GRAPHIC SURFACE

32 GRADATION SURFACE

31 BORDER SURFACE

Figure 3

#1 STARTING COLOR

#2 CHANGE RATE

#3 UNIT WIDTH

#4 AREA WIDTH

#5 NUMBER OF STEPS

#6 ENDING COLOR

Figure 8

#1 PATTERN GRAPHIC IMAGE INFORMATION

Figure 4

2 TIMING SIGNAL GENERATION UNIT

4 SCREEN DATA MEMORY

5 PATTERN GRAPHIC IMAGE GENERATION UNIT

6 LOOKUP TABLE

7 D/A CONVERTER

8 DISPLAY DEVICE

11 GRADATION IMAGE GENERATION UNIT

12 GRADATION MEMORY

13 BORDER COLOR GENERATION UNIT

14 SELECTION CIRCUIT

21 WINDOW SIGNAL GENERATION CIRCUIT

#1 CPU CONTROL SIGNAL

#2 TIMING SIGNAL

#3 CPU DATA BUS

#4 ROM DATA

#5 ROM ADDRESS

#6 COLOR BUS

#7 WINDOW SIGNAL

Figure 6

2 TIMING SIGNAL GENERATION UNIT

4 SCREEN DATA MEMORY

5 PATTERN GRAPHIC IMAGE GENERATION UNIT

6 LOOKUP TABLE

7 D/A CONVERTER

8 DISPLAY DEVICE

11 GRADATION IMAGE GENERATION UNIT

12 GRADATION MEMORY

13 BORDER COLOR GENERATION UNIT

14 SELECTION CIRCUIT

21 WINDOW SIGNAL GENERATION CIRCUIT

#1 CPU CONTROL SIGNAL

#2 TIMING SIGNAL

#3 CPU DATA BUS

#4 ROM DATA

#5 ROM ADDRESS

#6 COLOR BUS

#7 WINDOW SIGNAL

Figure 7

2 TIMING SIGNAL GENERATION UNIT

4 SCREEN DATA MEMORY

5 PATTERN GRAPHIC IMAGE GENERATION UNIT

6 LOOKUP TABLE

7 D/A CONVERTER

8 DISPLAY DEVICE

#1 CPU CONTROL SIGNAL

#2 TIMING SIGNAL

#3 CPU DATA BUS

#4 ROM DATA

#5 ROM ADDRESS

#6 COLOR BUS

Figure 9

#1 CONTROL DATA OF SCREEN AREA E1

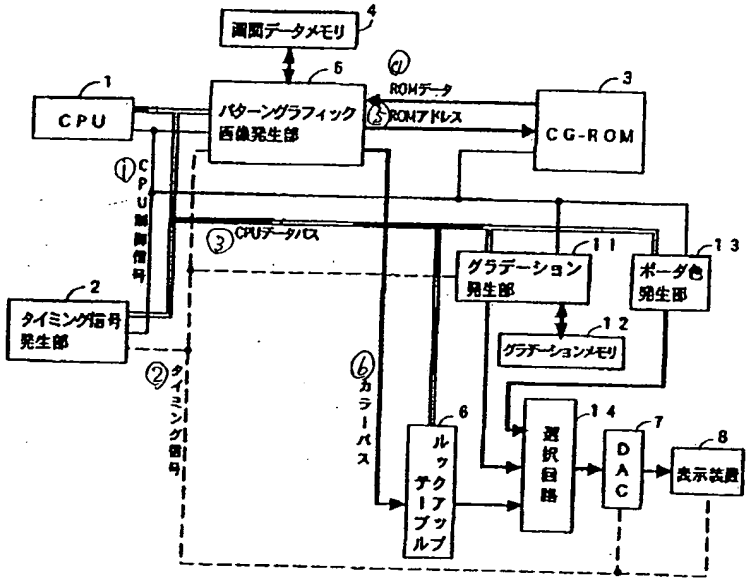
#2 CONTROL DATA OF SCREEN AREA E2

#3 CONTROL DATA OF SCREEN AREA E3

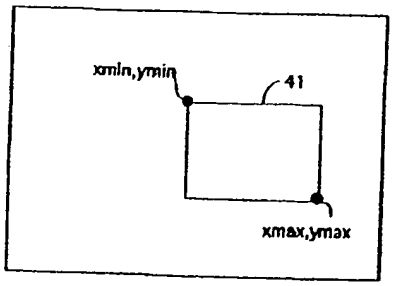
#4 CONTROL DATA OF SCREEN AREA EM

#5 SCREEN AREA

【図１】



【図５】



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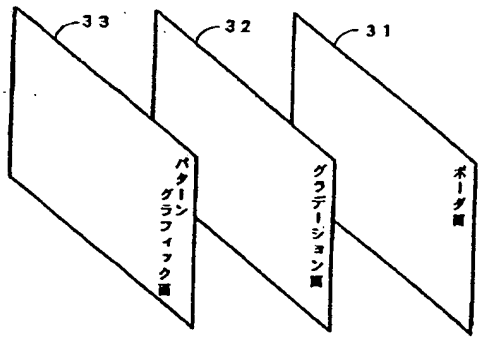

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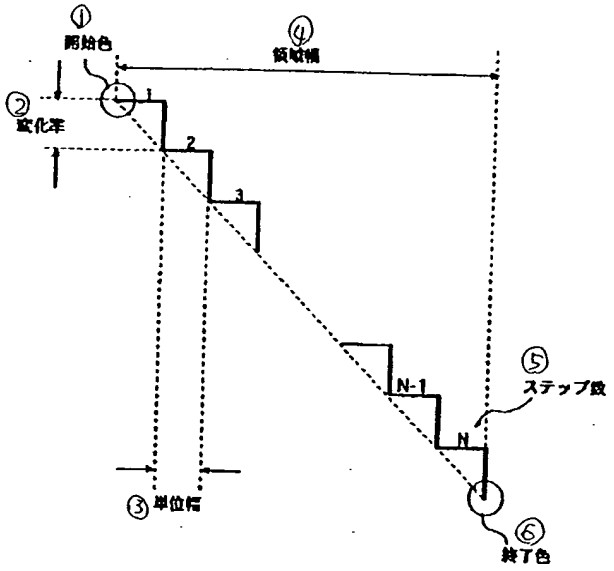

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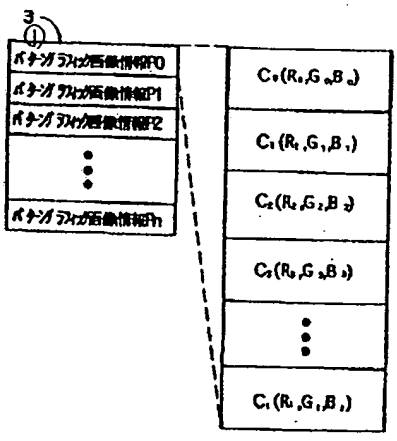

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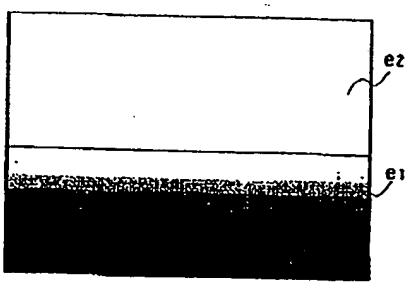

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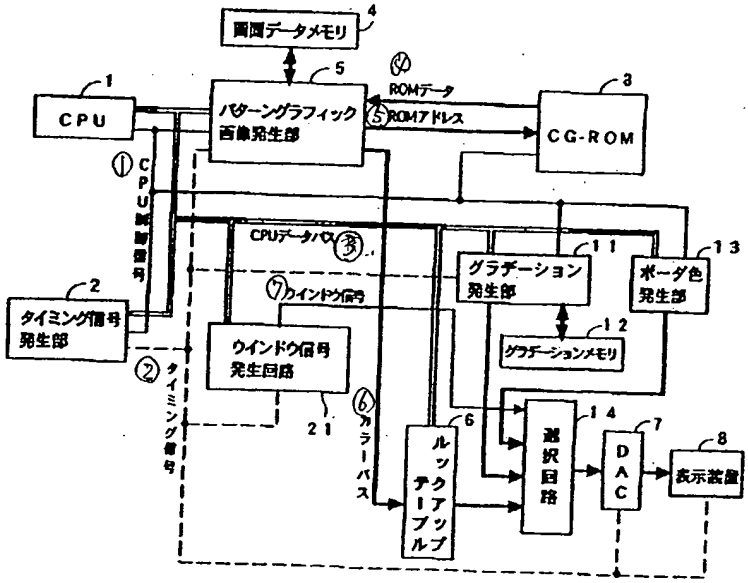
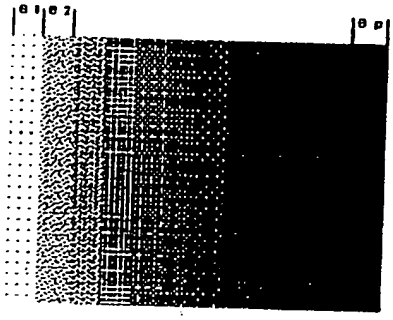
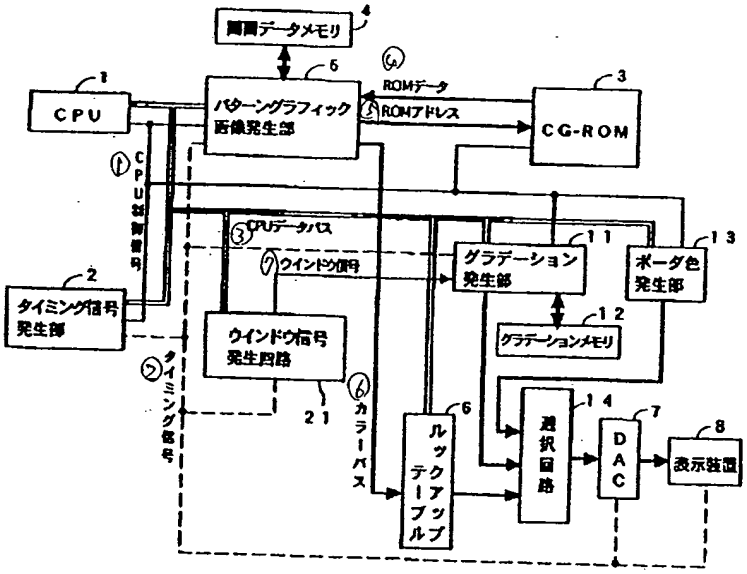

画面データメモリ
4
CPU
1
パターングラフィック画像発生部
5
ROMデータ
ROMアドレス
CG-ROM
3
CPU制御信号
CPUデータバス
ウインドウ信号
グラデーション発生部
11
ボーダ色発生部
13
タイミング信号発生部
2
グラデーションメモリ
12
ウインドウ信号発生回路
21
タイミング信号
カラーバス
ルックアップテーブル
6
選択回路
14
DAC
7
表示装置
8

【図１２】


θ1
θ2
θp

【図６】


画面データメモリ
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カラーバス
ルックアップテーブル
6
選択回路
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DAC
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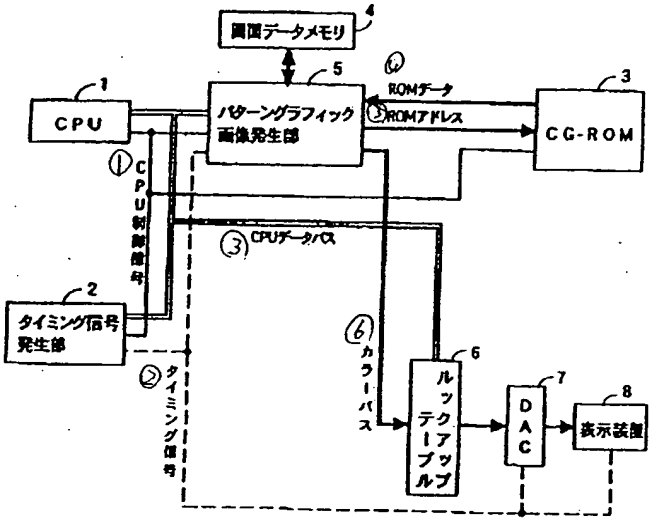
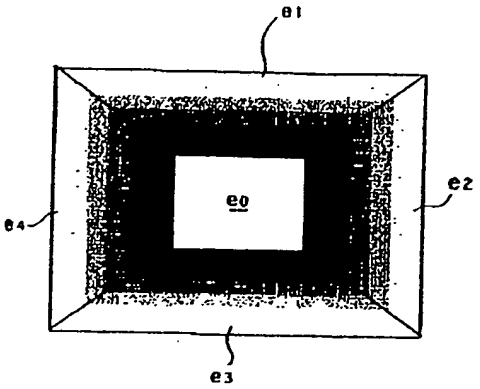
表示装置
8

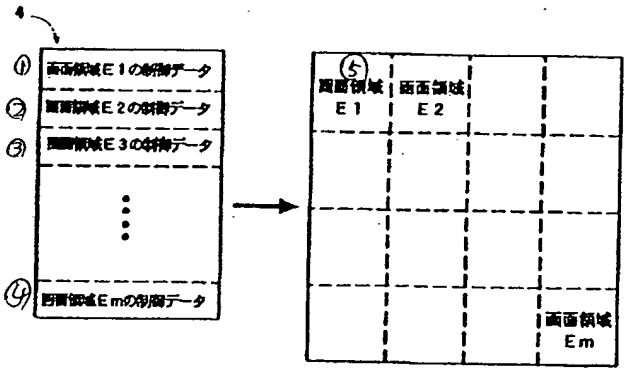
【図７】



【図１０】



【図９】



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